REMARKS

On page 2 of the final Action, claims 1 and 5-9 were rejected under 35 U.S.C. 103(a) as being unpatentable over Douglas in view of Bier. On page 3 of the final Action, claims 2, 3 and 10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Douglas in view of Bier and Baba et al. On page 4 of the final Action, claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over Douglas in view of Bier and Smith et al.

In view of the rejections, claim 6 has been cancelled, and the subject matter of cancelled claim 6 has been incorporated into claim 1.

As recited in amended claim 1, an ion trap mass spectrometer of the invention comprises an ion supply source for supplying ions; an ion storing section disposed near the ion supply source and having an entrance side close to the ion supply source, an exit side opposite to the entrance side, and means for providing an RF electric field for holding the ions inside ion storing section; an entrance gate electrode disposed between the ion supply source and the entrance side of the ion storing section, the entrance gate electrode being controlled to introduce and retain the ions in the ion storing section; an exit gate electrode disposed near the exit side of the ion storing section, the exit gate electrode being controlled to retain the ions in the storing section and emitting a bunch of ions; an ion trap section disposed at a side opposite to the ion storing section relative to the exit gate electrode; and control means connected to the entrance gate electrode, the exit gate electrode, the ion trap section and the ion storing section for controlling the same. The ion trap section includes means for cutting off an RF voltage while the bunch of ions emitted from the ion storing section enters the ion trap section, and means for suddenly applying the RF voltage when a maximum amount of the ions stays inside the ion trap section.

In the invention, the control means controls the entrance gate electrode and the exit gate electrode. Namely, the entrance gate electrode is opened and the exit gate electrode is closed to introduce the ions into the ion storing section; after a first predetermined period of time, the entrance gate electrode is closed while the exit

gate electrode is closed to accumulate the ions at the exit side of the ion storing section; after a second predetermined period of time, the exit gate electrode is opened to introduce the accumulated ions into the ion trap section at once.

In the invention, the means for providing the RF electric field provides an axial electric potential inclined from the entrance side to the exit side of the ion storing section so that the ions are confined and gathered near the exit side in the ion storing section. When the ions in the ion storing section is transferred to the ion trap section by the control means, a large amount of ions gathered near the exit side can be effectively sent to the ion trap section.

In Douglas, an ion trap mass spectrometer includes a chamber 42 defined by plates 40, 52 and having rods 44 therein, and an ion trap 58. The plates 40, 52 and rods 44 hold ions inside the rods 44, and the ions in the rods 44 are supplied to the ion trap 58. However, the rods 44 and the plates 40, 52 do not provide the axial electric potential inclined from the entrance side to the exit side. Therefore, the rods 44 can not gather the ions at the exit side. In the invention, the entrance gate electrode and the exit gate electrode are controlled to accumulate the ions at the exit side of the ion storing section, and the accumulated ions are supplied to the ion trap section at once. Although the ions are held inside the rods 44 in Douglas, the ions are not accumulated at the exit side. Thus, the features of the invention are not disclosed or suggested in Douglas.

In Bier, an ion trap mass spectrometer includes octopoles 19, 23 with an aperture 21 therebetween. The octopole 19 transmits ions from a skimmer 14 through the aperture 21, and ions through the aperture 21 are directed by the octopole 23 into an ion trap 24. After the introduction of ions into the ion trap 24, high voltage is applied to either octopole 19, 22, 23 or ion trap output lens 31 to block the passage of charged particles into the detector 25. The particles can be blocked to enter the ion trap 24 by applying low RF voltage to the octopoles.

In the invention, the means for providing the RF electric field provides the axial electric potential inclined from the entrance side to the exit side in the ion storing section. Thus, the ions are

confined and gathered near the exit side in the ion storing section. The octopoles 19, 23 in Bier do not provide the axial electric potential inclined from the entrance side to the exit side therein, so that the ions are not gathered near the exit side in the octopole 19 or 23.

Further, in the control means of the invention, the entrance gate electrode and the exit gate electrode are controlled to accumulate the ions at the exit side of the ion storing section, and the accumulated ions are supplied to the ion trap section at once. Although the entrance of the ions to the detector 25 or ion trap can be blocked in Bier, it is not disclosed or suggested that the ions are accumulated at the exit side and the accumulated ions are supplied to the ion trap section at once.

In regard to column 3, lines 17-19 of Bier, after the introduction of ions into the ion trap 24, the RF voltage applied to the quadrupole ion trap is ramped, as shown at 27, Fig. 2A. This means that the RF voltage as shown in Fig. 2A is applied to the electrode of the ion trap, not the octopoles 19, 23, to gradually eject ions from the small m/z value to detect the ions at the detector 25. Ions in the octopole 23 are not gathered at the side of the octopoles or the ion trap.

In regard to column 3, lines 28-30 in Bier, ions can be blocked by applying a low RF voltage to the octopoles 19, to prevent the transmission of the particles to the ion trap section.

Bier does not disclose or suggest the axial electric potential inclined from the entrance side to the exit side in the ion storing section, as defined in the invention. Therefore, the features of the invention are not disclosed or suggested in Bier.

In Baba et al., ions are trapped by concaved planar electrodes 17-20 inserted between gaps between linear trap electrodes 1-4. In the embodiment shown in Figs. 11-12, the electrodes 63' are connected to resistors with an appropriate resistance R for a linear RF quadrupole ion trap. In this system, the static potential by the arrays of planar electrodes traps the ions in the direction of the central axis. In the invention, in addition to the ion trap section, the ion storing section is formed, wherein the axial electric

potential is inclined from the entrance side to the exit side. Baba et al. does not disclose or suggest that the means for providing the RF electric field provides the axial electric potential inclined from the entrance side to the exit side of the ion storing section so that the ions are confined and gathered near the exit side in the ion storing section. Although the electrodes are connected to the resistors in Baba et al., the features of the invention are not disclosed or suggested in Baba et al.

In Smith et al., elements have successively larger apertures to form an ion funnel. RF voltages are applied to the elements so that the RF voltage on the element has phase, amplitude and frequency necessary to define a confinement zone for charged particles of appropriate charge and mass in the interior of the ion funnel. In the invention, the means for providing the RF electric field provides the axial electric potential inclined from the entrance side to the exit side of the ion storing section so that the ions are confined and gathered near the exit side in the ion storing section. Smith et al. has the series of elements, but the elements are not designed to be used for the ion storing section in association with the ion trap section. The features of the invention are not disclosed or suggested in Smith et al.

As explained above, the cited references do not disclose or suggest the features of the invention. Even if the cited references are combined, the features of the invention are not obvious from the cited references.

Reconsideration and allowance are earnestly solicited.

Respectfully submitted,
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